

THE brilliant morning and evening glows have not yet left us. In connection with a letter of one of your correspondents of December 20, 1883, it may be interesting to add that the year 1783, which was characterised by a fearful eruption of Skaptar Jokul in Iceland, and by remarkable sky-colour phenomena similar to those we have lately had, was also the year in which the last great eruption of Asama Yama in Japan took place (see *Transactions of the Asiatic Society of Japan*, vol. vi. part ii. p. 327). Asama Yama is the greatest active volcano in Japan. In connection also with the unusual quantity of aqueous vapour with which the atmosphere has been charged, as proved by the spectroscopic observations of Prof. Michie Smith and others, and the facility that dust particles give for the formation of clouds, and therefore also of snow, it may be interesting to note that the beginning of the present year has been characterised by the greatest fall of snow that the oldest inhabitants here have known for thirty years. The minimum temperature reached this winter (- 28° C. on the morning of December 23 in the neighbourhood of the college) is also the lowest for Kingston during the same period. Prof. Goodwin is now engaged in analysing the snow in order to find out whether similar impurities to those found in Europe and in Java are present.

D. H. MARSHALL

Queen's University, Kingston, Canada, January 13

Circular Rainbow seen from a Hill-top

In the *Philosophical Magazine* for January, 1884, p. 61, is an interesting article by Prof. Tyndall describing experiments made to produce circular rainbows by artificial light and artificial mist, his attention having been attracted to the subject by an observation made in the Alps on one occasion when the shadow of his body was projected at night time on to mist by a lamp behind him, and was seen to be surrounded by a luminous circle, or halo of light. I was so fortunate as to see lately identically the same effect produced with remarkable beauty and completeness in broad daylight from the summit of a Welsh hill. Staying last week for a couple of days at Pen-y-Gwryd, near Snowdon, in company with a friend, we walked one morning up the Glydr-Vach. The rain was steadily descending as we left the little inn, and the thick mist swathed the hill-sides in obliterating folds. Just as we reached the summit at noon a slight breeze thinned away the mist in front of the sun, and a burst of sunshine illuminated the hill-tops. Clambering on to the natural cairn which crowns the summit, we looked down into the valley, in which lies the small lake Llyn Idwal. Along the valley the wind drove masses of thin mist and scud, and on this we saw to our surprise the shadow of the summit with our own sharply-marked shadows projected on it. We waved our arms, and the mystic figures replied by waving theirs. Surrounding these immense shadowy figures we could see two concentric rainbows completely circular, the centre being the shadow of our heads. The colours of the inner rainbow were in the order of the primary bow, and the outer was a secondary and more faintly-tinted rainbow. During all this time the sun was shining brightly on our backs; when the wind cleared away the mist completely in the valley, the shadows and the rainbows vanished, but reappeared when fresh masses of vapour were blown into the line of our shadows. A very rough attempt at determining the angle subtended by the diameter of the primary bow seemed to show that it was much less than 90°, in fact not probably above 20°. This interesting appearance lasted only for a few minutes, as the wind drove up fresh mist in front of the sun, and the rainbow-circled phantoms disappeared. It would be interesting to know if any of your readers have ever observed a similar phenomenon. It has, I believe, been seen by balloonists when the altitude of the sun is great and a layer of mist and cloud lies beneath. Shadows thrown on mist are common; but this rainbow addition was new, not only to me, but to my friend, and his mountaineering experience has been very considerable.

J. A. FLEMING

Unconscious Bias in Walking

MR. LARDEN's letter in your issue of the 17th inst. (p. 262) regarding "circling to the left in a mist," and the replies of Messrs. G. H. Darwin and Hawksley, have opened an interesting question, and one which seems to be but imperfectly understood. The true explanation of this vexed question has for some years appeared to me to be that to which it is attributed by Mr. Hawksley, namely, inequality in the length of the legs. A

few years ago I made some investigations on the length of the lower limbs in man, the results of which were published in the *Journal of Anatomy and Physiology*, vol. xiii. p. 502 (1879). I found that of seventy well-authenticated skeletons which I examined, the lower limbs were equal in length in only seven instances, or in 10 per cent.; in twenty-five instances, or 35.8 per cent., the right limb was longer than the left, while in thirty-eight instances, or 54.3 per cent., the left limb was longer than the right. The left leg I found not only to be more frequently longer than the right, but the difference in length between the two limbs is greater on an average when the left is the longer. Inequality in length is not confined to any particular age, sex, or race, but seems to be universal in all respects. My observations corroborated those of several American surgeons made on the living subject. The result of one limb being longer than the other will naturally be that a person will unconsciously take a longer step with the longer limb, and consequently will circle to the right or to the left according as the left or right leg is the longer, unless the tendency to deviation is corrected by the eye. The left leg being more frequently the longer, circling should, if this theory of its being due to inequality of the limbs be correct, take place more frequently to the right than to the left. This is precisely what we find to obtain, and in this respect Messrs. Larden, Darwin, and Hawksley's observations agree with some I made myself on this question. The diameter of the circle formed by those circling to the right should, if my observations on the skeletons be correct, be less than that made by those circling to the left, since the difference in length between the two limbs is greater when the left is the longer.

To determine the comparative lengths of the right and left arms I made observations on fifty skeletons (the first fifty of those measured to estimate the length of the lower limbs), the results of which I hope to publish soon. In thirty-six of these skeletons, or in 72 per cent., the right arm is longer than the left; in twelve, or in 24 per cent., the left arm is the longer; and in two, or 4 per cent., the arms are of equal length.

On comparing these measurements of arm and leg in the fifty skeletons the right arm and left leg are longer than the left arm and right leg in twenty-three instances, or in 46 per cent.; the left arm and right leg are longer than those of the left side of the body in thirteen instances, or 26 per cent.; the latter are the longer in four instances, or 8 per cent.; while in the remaining four skeletons the legs are of equal length but the right arm is longer than the left in two instances, and the arms are equal in two cases, but the left leg is the longer in one of those and the right in the other.

Asymmetry of both upper and lower limbs, then, is the rule, and not the exception, as might naturally be supposed. Not knowing the histories of the persons whose skeletons I measured, I am unable to throw any light as to the connection between the proportions of the limbs and right- and left-handedness.

The particular causes of inequality in the length of the bones of the right and left sides of the body will probably always be more or less a matter of theory. The general cause is, as Mr. Hawksley states, owing to more rapid growth of the one limb than the other. I do not think in the majority of instances it can be attributed to "illnesses to which we are subject in early life," as he surmises. Asymmetry is almost invariably found throughout the whole skeleton, for example it is extremely rare to find a skull the two sides of which are absolutely symmetrical. In the limbs it is perhaps more easily attributable to the blood-supply being greater to one bone than to another. The nervous system may also have to be taken into account as a cause.

J. G. GARSON
Royal College of Surgeons, London, January 26

I AM left-handed and left-footed; that is, if there is anything to do that requires strength or skill, the left hand is always used; in football-playing, or anything requiring the use of the foot, the left foot gets the work to do.

I remember being once lost in the woods in America whilst trying to make a short cut home, and, after walking a good many miles, came upon my own snow-shoe track on its left side; thus my bias had been from right to left.

In a bitter cold day with thick snowdrift and a gale of wind on our "left front," as a soldier would say, some men were on a sledge journey on the Arctic coast in 1847. It was important

to reach a certain point, and each of the party in turn (including an Esquimaux) took the lead, but all failed to keep the correct course beyond a minute or two, so that the constant stoppages necessary to consult the compass were trying to the hands; in fact one of the native dogs, protected by a thick fur, fairly succumbed to the cold, and the poor thing had to be abandoned to its fate.

We at last thought of placing an Esquimaux boy of about fourteen as leader, and he managed to keep a straight course with wonderful accuracy, although he walked crab-fashion, sideways, so as to protect his face from the bitter blast.

Is Mr. Larden's theory correct, namely, "that those in whom the left leg is strongest would circle to the right?" I think not, because according to my idea it is the leg from which one steps, and not the leg that *takes the step* or that is placed in advance that imparts the impetus; so that a strong left leg would cause the step with the right foot to be longest, and the person would circle to the left.

JOHN RAE

4, Addison Gardens, January 26

WITH reference to the letters by Messrs. Darwin and Hawksley in the current number of NATURE (p. 286), I may say that I am very strongly "left-legged" (also strongly right-handed), but so far as I am aware there is not the slightest difference in the lengths of the two limbs. I became aware of the peculiarity when a child, by noticing that on a slide the other boys used to go right foot first, and I left foot. Subsequent attempts to break myself of the habit only resulted in my coming ignominiously to grief, and if I tried now to leap a ditch right foot first I would tumble headlong into it instead of clearing it. The next time I find occasion to *kick* I will try to remember which foot was used. It is right to state, however, that in my case I think there has probably existed from infancy a very slight natural weakness of the right ankle. Attempts with me to walk a straight line with the eyes shut seem invariably to result in my swerving to the left, which appears to be contrary to Mr. Darwin's experience.

Lewisham, January 25

R. McLACHLAN

MIGHT not the longer step taken by one leg be explained as follows:—

Most people when standing at ease habitually throw their weight on one leg; but, whichever it be, its movement is more likely to disturb the balance of the body. It would therefore be more quickly replaced on the ground, and a shorter step would result.

The unequal steps would not necessarily effect a circular course, as may be easily shown by experiment. A divergence, say, to the right would be caused by the left leg swinging in its step towards the right, and such would be its natural movement if the body inclined to the right. Now a person who constantly stands more on the right leg than the left would have that inclination in his walk, in spite of the alternate removal of the burden from each leg. This tendency to lean towards the right would be still further encouraged by the ancestral or individual use of the walking-stick in the right hand.

The suggestion of Mr. G. H. Darwin (January 24, p. 286) that the mounting a horse on the left side may be accounted for by the sword is strengthened by the freedom of the sword-arm requiring that the left hand be used to grasp the reins, which is the first act in mounting. There would be a momentary want of control over the horse if, under these circumstances, it were mounted from the right side.

F. M. CAMPBELL

Rose Hill, Hoddesdon, January 28

IN a letter to you about another subject Mr. G. H. Darwin suggested last week that the British rule of the road for riding was justified by the advantage of having your sword hand towards a stranger, but why then should the rule of the road in walking be, what I understand it to be, the reverse of the rule in riding?

I would suggest that perhaps the rule in riding is adopted from the rule in driving, and that the latter results from the fact that a driver may be assumed to carry his whip in his right hand and therefore to sit to the right if there be two on the driving seat, and that when he is so seated he can see better how he is passing another vehicle if our rule is adopted.

This, like Mr. Darwin's suggestion, would leave us without explanation why most nations have adopted a rule the reverse of ours.

It would perhaps be hardly scientific to say it is because Englishmen are always right and foreigners always wrong, nor would it be much more so to say that it is because English drivers like to make a close shave and foreigners as a rule give an obstacle a wide berth, for the latter fact, if it be an observed fact, may be the effect, not the cause, of the rule of the road. Can it be that the foreign rule was adopted where it was customary for the driver to sit alone on his seat and could therefore see equally well on both sides, and at the same time wished to have freedom to use his whip.

STEPHEN A. MARSHALL

Diffusion of Scientific Memoirs

When, in reviewing Prof. Stokes' *Reprint*, I spoke of "the almost inaccessible volumes of the *Cambridge Philosophical Transactions*," I was referring expressly to the *Transactions* only, and to the period 1845-54. That there are now 120 "centres" in which "Transactions or Proceedings, or both" are accessible, is an interesting and important fact, but wholly beside the question raised by my remark. [I leave out of account copies sent to Honorary Fellows; for these are not more accessible than those obtained by Ordinary Fellows.]

The question at issue between the Secretary of the Society and myself is:—What was the state of matters in 1854? Mr. Glazebrook gives me data for the present time, and for 1869, only. From these it is not possible to obtain more than an approximate answer to the question. But, in default of further data, I assume that (in accordance with the published statistics of similar Societies) the number of Hon. Fellows of the C.P.S. has not changed since 1854; and that the increase of "centres" from 1854 to 1869 was nearly the same as from 1869 to the present time. It follows from Mr. Glazebrook's data that the number of "centres" in 1854 must have been about 40 only.

But I referred to *Transactions* alone, not to "Transactions or Proceedings, or both." To obtain a rough idea of the correction to be made on this account, I take the numbers for the Royal Society of Edinburgh (with which I am best acquainted, and which are at least as large as those for the Royal Society). In Mr. Glazebrook's form of statement, these numbers are at present

Hon. Fellows	...	...	...	...	...	...	...	56
Total number distributed	...	...	...	...	...	...	...	343

Deduct the first number, and there remains 287. But of these "centres" 96 (one-third, say) receive *Proceedings* only.

Hence it would appear that, in 1854 and previous years, to which alone I referred, the *Cambridge Philosophical Transactions* were to be found at some 27 "centres" only; say 10 at home and 17 abroad. Surely this would much more than justify the term "almost inaccessible"!

I cannot recollect having made any application for the C.P.S.'s publications, though I have often asked Cambridge friends why I did not get them regularly. But, according to Mr. Glazebrook's view, I should either have received all, or *none*.

The state of matters, in the three Edinburgh "centres" to which Mr. Glazebrook alludes, is at present as follows:—

All three "centres" have the *Transactions* complete; except the University Library, which wants vol. xiii. parts 1 and 2.

The Advocates' Library has not the *Proceedings*; the Royal Society wants vols. i. and ii., all but a few pages; and the University Library wants vol. iv. parts 1, 2, 3, 4, 5. Thus one "centre" has no *Proceedings*, another has almost half, and the third three-fourths.

I must, in concluding, repeat my hope that NATURE may do a new and great service to science by collecting full statistics as to the "centres" at which the publications of the various scientific Societies are accessible.

P. G. TAIT

College, Edinburgh, January 26

Water in Australia

REFERRING to my letters in NATURE of May 12, 1881, and March 30, 1882, on the underground water supply of Australia, it is interesting to observe that the search for it is being actively carried on by some energetic colonists, and that their efforts are successful. The following extract from *The Queenslander* of May 26, 1883, shows what can be done:—

"The subterranean waterflow now proved to exist beneath the vast arid plains of the west has been tapped at yet another